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EVOLUTION OF THE CHIN

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In the Smithsonian Report for 1914 is an article by Louis Robinson, M.D., on "The Story of the Chin." Dr. Robinson in this article goes so far as to explain the presence of a chin in human beings as the result of the habit of articulate speech. Quite a different explanation is possible for the existence of this extraordinary feature of our anatomy. I should like to suggest some of the evidence which would seem to indicate that Dr. Robinson's ideas need rather careful review.

By chin is to be understood the projection or point on the under jaw, below the mouth (Fig. 1). The jaws of most vertebrates have no *projection* or prominence in this region.

It will therefore be recognized at the outset that the chin is a very "human" trait. It is a trait that distinguishes man from other living primates; even from his near relatives (compare Figs. 1 and 2). It even sets off the man of to-day from the more ancient of his progenitors. The earlier fossil skeletons of man are quite chin-

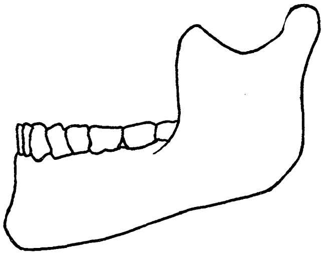

FIG. 1. Recent human lower jaw, showing the so-called "mental" or "chin" prominence.

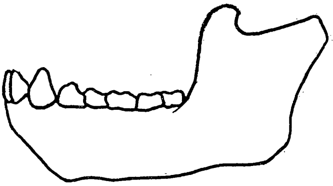

FIG. 2. Lower jaw of an orang, showing the absence of chin.

less. The absence of this bony projection in the face is in fact one characteristic thing in our more or less apelike forefathers (Figs. 3 and 4). The question is, how the "evolution" of this chin is to be explained.

Dr. Robinson's explanation seems to me to boil down to this: that man is, before all other creatures, a talker. In talking, the genio-glossus muscle is called upon to do the most work. This is a fan-shaped muscle which composes a large part of the under portion of the tongue, and is attached to the inner surface of the jaw just within the chin. It is, according to Robinson, larger, more specialized in structure and more fully fasciculate in man than in the monkeys. The chin, then, says Robinson, is the point of origin for this elaborate muscle, which in a minute of conversation makes several hundred separate movements. The chin has crowded forward in its present conspicuous form as successive generations of men developed more adequate apparatus for speech. In other words, the chin developed because of the use and the consequent development of this one "talking-muscle."

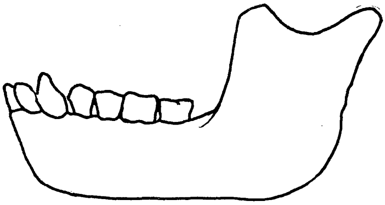

FIG. 3. The lower jaw of an ancient ancestor of man; the "*Eoanthropus dawsoni*," an early Pleistocene form from Piltdown, Sussex (sketched from the restoration by Dawson and Woodward).

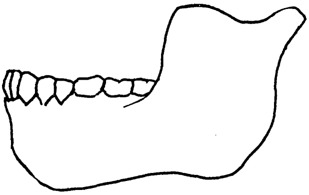

FIG. 4. The lower jaw of *Homo heidelbergensis*, a Pleistocene ancestor of recent man, found at Mauer near Heidelberg.

It is only fair to remark that this is an old discussion. Walkhoff, in a series of papers, beginning with a volume edited by Selenka in 1901,[1] put forward the theory now rejuvenated by Robinson. The suggestion was critically reviewed by Fischer in a series of articles.[2] Since then the idea has appeared in a variety of journals.

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[1] *Ausz. Biol. Centralbl.*, Volume 22.

[2] Especially *Anat. Anz.*, Volume 23 (1903); Volume 25 (1904).

It is only proper to say, further, that Robinson's various statements about the matter are hardly consistent. He states that the chin is, in origin, merely a buttress for the canine teeth; and he also believes it to be the result of sexual selection. Having accounted for it in these two ways, he throws in his remarks about the genio-glossus muscle for good measure. He closes by spending more discussion on the genial tubercles than on the chin itself. If the first of the statements to which reference has been made is correct, those animals which have large canines ought to be found with the best-developed chins. Quite the opposite is the case. Generally speaking, animals with very large canines, such as the baboons and others, are conspicuous for their very lack of chin. The author also makes certain sensational statements about the lower jaws of the "lower" races, that need full discussion; assuming in one place that uncivilized peoples have phonetically simple languages, an assumption which is startlingly contrary to the facts. His assumption that the genio-glossus muscle is the one prime factor in speech is not borne out by phoneticians, as he himself notes in one place (page 305). Aside from such minor points, all of which demand argument, I should like to point out what seem to my mind to be some of the more important reasons for considering his theory of the origin of the chin imperfect.

In the first place, if man's chin develops from his talking habit, all other animals, without exception, should lack chins altogether. None of them have a language, properly speaking. Robinson himself, to go no further, mentions other animals, notably the elephants, who do possess chins. The latter have it, as the saying is, to spare—much more than a human being has. Robinson points out quite correctly that talking and the chin develop together, as we observe man evolving through various types. This does not necessarily mean, as Robinson seems to assume, that talking produces the chin. On the contrary, the gluteus maximus muscle undergoes tremendous development throughout the same period which brought in highly specialized language. No one has ever suggested, however, because it develops along with highly specialized language, that this muscle is concerned in speech. I should say that the proper method is to see whether there is any general tendency which would produce chins in the course of evolution, a tendency which would operate in the case of other animals, and also in the case of man and his forerunners. I think there is such a general principle, and a very simple one. I should be inclined to explain the chin, not as a by-product of speech, but as a result of a general reduction in the size of the jaw.

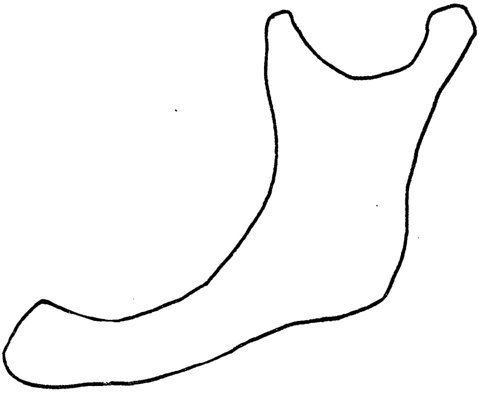

FIG. 5. The lower jaw of an aged person, showing the reabsorption of the alveolar border.

The man-like apes have very heavy chin-less jaws, which, in point of absence of chin, compare with the jaws of the great dogs or cats. Fossil man, too, exhibits, in the more ancient types, enormously large jaws. One general fact, then, in the evolution of modern man, has been a reduction in the size of this part of the body structure. This reduction went along with wider intelligence in the selection of food, and has perhaps been accelerated in man's case by the invention of cooking and other artificial treatment of food-substances. It is, then, a general tendency in the evolution of the human and related types. If we can not explain it, we may at least recognize it. The next question is: if the jaw is in this way being reduced, should we naturally expect it to be equally reduced in all directions? There are reasons why we might anticipate that it would not.

If we consider especially the horizontal ramus of the jaw, the fact is striking that not all parts of it are equally permanent. The teeth themselves, and the upper border of the ramus, are temporary structures. In old age, the teeth are lost. The upper margin of the jaw itself is, in late life, reabsorbed (Fig. 5), which, with a corresponding loss in the upper jaw, produces the well-known nutcracker appearance of the aged human face. Without attempting to dogmatize, I will go so far as to say that we might confidently expect that the region in the lower jaw which is lightest in structure, and the first to disappear in the individual, would be the part which would naturally respond first to the influence of external environment. Put in another way, the suggestion might be worded thus: We recognize as the important thing in the jaw the *teeth.* Hence, as smaller teeth became more appropriate through change of habit and environment, changes would first appear in these teeth themselves, and in the tissues which immediately support them. In fact, in the fossil "Heidelberg" jaw the teeth have been reduced faster than the jaw itself.[3] Granted that our ape ancestor had a jaw, it

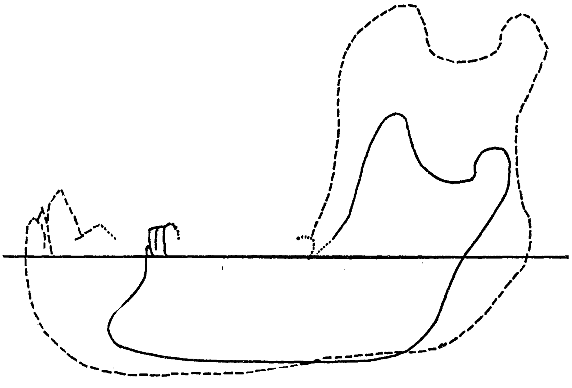

FIG. 6. Lower jaw of the gorilla (broken line), compared with the lower jaw of recent man (adapted from Schoetensack). If the recession in successive gorilla jaws were more rapid in the upper than in the lower border, a prominence would be produced as shown in the human jaw.

is to be expected, it seems to me, that during a general contraction in its size, the superior margin would retract more rapidly than the inferior. I am inclined to think that the chin is the persistent lower margin of our large ancestral jaw. This margin has become retracted more slowly than the upper margin, and therefore juts out into space (Fig. 6).

A difficulty immediately suggests itself. If a *human* chin results from reduction in the size of the jaw, wherever in different species of animals jaws have become reduced, we ought logically to find chins. One striking case can be cited in line with this suggestion. The case of the elephant suggests itself at once, and very clearly. We know that his jaw bones are the result of a remarkable retraction. The process is one of the most picturesque that we know about.[4] We duly find in the geologically recent elephants, and especially in the living species, a tremendous chin (Fig. 7). Whether still other cases of chins resulting from retraction could, or could not, be cited, I do not know. I very strongly suspect, however, that a thorough knowledge of paleontology would put one in position to cite a considerable number, though possibly few cases would be so clear as that of the elephant. I can not resist the feeling that in some such process we have the explanation, not only of human chins, but the chins of other animals as well.

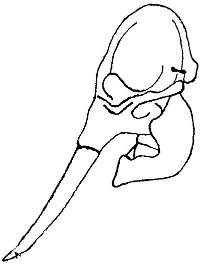

FIG. 7. Face of the Indian elephant (recent), showing the presence of a conspicuous chin which has resulted from reduction in the length of the jaw.

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[3] A fact mentioned by MacCurdy in the Smithsonian Report for 1909 (page 570).

[4] Interestingly described by Sir Ray Lankester, "Extinct Animals."